

ABSTRACT OF THE INVENTION

A luminescent semiconductor nanocrystal compound is described which is capable of linking to an affinity molecule. The compound comprises (1) a semiconductor nanocrystal capable of emitting electromagnetic radiation (luminescing) in a narrow wavelength band and/or absorbing energy, and/or scattering or diffracting electromagnetic radiation - when excited by an electromagnetic radiation source (of narrow or broad bandwidth) or a particle beam; and (2) at least one linking agent, having a first portion linked to the semiconductor nanocrystal and a second portion capable of linking to an affinity molecule. The luminescent semiconductor nanocrystal compound is linked to an affinity molecule to form an organo luminescent semiconductor nanocrystal probe capable of bonding with a detectable substance in a material being analyzed, and capable of emitting electromagnetic radiation in a narrow wavelength band and/or absorbing, scattering, or diffracting energy when excited by an electromagnetic radiation source (of narrow or broad bandwidth) or a particle beam. The probe is stable to repeated exposure to light in the presence of oxygen and/or other radicals.

Treatment of a material with the organo luminescent semiconductor nanocrystal probe, and subsequent exposure of this treated material to excitation energy, to determine the presence of the detectable substance within the material bonded to the probe, will excite the semiconductor nanocrystal in the probe bonded to the detectable substance, causing the emission of electromagnetic radiation of a narrow wavelength band and/or the detectable absorption, and/or scattering or diffraction of energy signifying, in either case, the presence, in the material, of the detectable substance bonded to the organo luminescent semiconductor nanocrystal probe. Since the semiconductor nanocrystals in the probe are excitable over a broad bandwidth of energy, and emit electromagnetic radiation over a narrow bandwidth, it is possible to use a single energy source to simultaneously excite a plurality of such probes, each emitting electromagnetic radiation of a differing wavelength band to simultaneously analyze for a plurality of detectable substances in a material being analyzed.

Further described is a process for making the luminescent semiconductor nanocrystal compound and for making the organo luminescent semiconductor nanocrystal probe comprising the luminescent semiconductor nanocrystal compound linked to an affinity molecule capable of bonding to a detectable substance. A process is also described for using the probe to determine the presence of a detectable substance in a material.